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Explora México: A mobile application to learn Mexico's Geography.

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Abstract

In this paper we present the development of a mobile application (named Explora México) for 9 to 10 years old children as a complementary learning tool for Mexico's geography and develop multiple intelligences through gamification techniques. The content to develop such learning activities was taken from the official curricula from SEP (Secretaría de Educación Pública, Public Education Bureau) 4th grade elementary level Mexico's Geography book. Explora México consists in 450 multiple choice questions in order to have more than one correct answer in the advanced levels. The learning activities were developed keeping in mind the Constructivism theory with the objective to develop multiple intelligences according to Howard Gardner's theory. Geography provides an excellent opportunity to develop spatial, naturalistic and interpersonal intelligences, and provide appropriated feedback to the student is an important process to allow student analyze, interpret and evaluate their answers. Gamification techniques were considered to engage and motivate the child, each correct answer gives bonus coins which later can be trade for Mexico stickers and augmented reality (AR) car game accessories. Mexico's stickers and the AR game become a great motivation to the child who becomes eager to collect more coins by answering more questions; it is also a great activity to support and according to Garner's theory to develop kinesthetic intelligence.

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Nomenclature

AR	Augmented Reality
VR	Virtual Reality
GUI	Graphical User Interface
SEP	Secretaría de Educación Pública (Public Education Bureau)
MI	Multiple Intelligences

1. Introduction

This paper we describe a project developed in collaboration with Instituto Tecnológico y de Estudios Superiores de Monterrey (ITESM), IDEA Group, and Soluciones EXA, under the general collaboration agreement promoted by the interactive media cluster of Nuevo Leon, state government of Mexico.

The goal of this project was to create a mobile application (named Explora Mexico) to support the learning process of Mexico's geography for children between 9 to 10 years according to the content of the official curricula from SEP (Secretaría de Educación Pública, *Public Education Bureau*) 4th grade elementary level Mexico's Geography text book.

Explora: México was created by minding new technologies and the way kids interact with them. Since the social media and mobile revolution started, kids yearn to incorporate the digital world into their lifestyle. Our goal is to focus their distractions by fulfilling their need for media and entertainment with an educative application for mobile devices.

The topic was something that was carefully chosen, we wanted to focus on a subject that most schools on our country were teaching and there were not many applications developed for iOS. This led us to eliminate most subjects like mathematics, physics, chemistry, etc. And focus more on subjects like history, geography of Mexico. We found three apps that talk about the history of Mexico but none of the geography, so we choose geography of Mexico for our main subject.

1.1. Multiple intelligences theory

Proposed by Howard Gardner the multiple intelligences theory [1], propose a model that articulates criteria to consider intelligence [2], and with these base Gardner chose first eight abilities and leather one more [3-4] that meet with these criteria (table 1).

Table 01: Types of Multiple Intelligences

Type of MI	Description
Musical - Rhythmic	This area has to do with sensitivity to sounds, rhythms, tones, and music.
Interpersonal	This area has to do with interaction with others [1].
Intrapersonal	This area has to do with introspective and self-reflective capacities.
Visual - Spatial	This area deals with spatial judgment and the ability to visualize with the mind's eye.
Verbal - Linguistic	People with high verbal-linguistic intelligence display a facility with words and languages.
Logical - Mathematical	This area has to do with logic, abstractions, reasoning, numbers and critical thinking.
Bodily - Kinesthetic	The core elements of the bodily-kinesthetic intelligence are control of one's bodily motions and the capacity to handle objects skillfully.
Naturalistic	This area has to do with nurturing and relating information to one's natural surroundings
Existential	This propose spiritual or religious intelligence, suggested that an "existential" intelligence may be a useful construct.

1.2. Gamification techniques

Repetition is one of the most common technics in learning, yet it might be described as a boring method or looked down as a memorizing only technic. The fun an entertainment factors have proved to make the difference between learning and forgetting and learning and remembering [5].

Gamification a word proposed by Nick Pelling [6] or the use of game strategies, in a non-game context, according with Herger [7] it has been widely used to engage users to participate actively in processes and activities improving user experience in learning. Gamification satisfy the natural desire to archive results and competition, giving incentives or rewards for players as points and giving them the opportunity to exchange by his preferred objects.

2. Development

Development of Explora México application integrates previous theories to accomplish children development and motivation, but it is important to link with learning content, learning activities, graphics design and illustration. In this section we provide more details about this.

2.1. Content

The geography course in primary education keep tracking of previous courses based on the learning of students in relation to the space where they live, to recognize the distribution and relationships of the components of natural, social, cultural, economic, political and geographical space, on scales local, state, national, continental and global levels, by developing integrated concepts, skills and attitudes that contribute to building local identity, state and national, to assess the natural, social, cultural, and economic linguistic, and participate in situations of everyday life to caring for the environment and disaster prevention.

The content to develop such learning activities was taken from the official curricula from SEP (Secretaría de Educación Pública, *Public Education Bureau*) 4th grade elementary level Mexico's Geography book grouped in 5 learning units (fig 1).

I. In search of Mexico



II. Natural diversity



III. Population diversity



IV. Economic diversity



V. The Mexico's challenges



Fig. 1. Learning units for 4th grade basic school, SEP.

The Digital Skills Curricular Standards for public education present a vision of a population that uses digital media and environments to communicate ideas and information, and interact with others. Involve understanding concepts, systems and operations; this is considered in the SEP curricula including geography in third grade use digital tools to solve different types problems.

2.2. Graphic design

We considered our target audience to illustrate this application; a couple of characters, a young eagle and a young snake (fig. 2) were developed to make it friendlier. They are fellow adventurers through this learning journey. The young eagle, as a freedom symbol, becomes the mentor while the young snake represents the child's fellow and provides feedback during the learning adventure.

Audiovisual content, multimedia, AR and programming articulate a rich environment with varied experiences, from which the students create their own learning.



Fig. 2. Fellow adventures in Journey.

The illustration on the graphics of this project is based on colors and graphics typical of geography education books, also was considered the average age of children who will use the application. Each learning unit and its graphical elements are based on the themes of the printed unit.

One of the most important elements in the Mexicans experience is the variety of colors and their mix. We used those elements in our concepts applied in the entire project.

2.3. Learning activities

The learning activities were developed keeping in mind the Constructivism theory with the objective to develop multiple intelligences according to Howard Gardner's theory. Geography learning provides an excellent opportunity to develop spatial, naturalistic and interpersonal intelligences (fig. 3). Furthermore it provides appropriated feedback to the student after answering a question; this is an important process especially when the answer is incorrect because the child is allowed to learn by getting constructivist feedback. As a result the student is able to analyze, interpret and evaluate the answer.

Explora México is based on the expected learning objectives established on the Geography syllabus using still and animated images, audio and videos to present dynamic, creative and interactive learning scenarios and situations.

Explora México consists in 450 multiple choice questions in order to have more than one correct answer in the advanced levels.



Fig. 3. Sample of learning activities.

The educational materials used by the school community allow enjoyment in the use of leisure time, the creation of learning networks and communities in which the teacher is seen as a mediator for the appropriate use of educational materials. Since this approach is suggested to obtain evidence and provide feedback to the students throughout their training, and that they receive about their learning, allowed to participate in improving their performance and expand their opportunities to learn.

2.4. Gamification techniques

Gamification techniques were considered to engage and motivate the child, each correct answer the student respond, gives bonus coins which later can be trade for Mexico stickers and cars and accessories to play with an augmented reality (AR) car game. The exchange process is registered in the child's adventures book ("Libro de aventuras de viaje por México") (figs 4 and 5). Mexico's stickers and the AR game become a great motivation to the child who becomes eager to collect more coins by answering more questions; it is also a great activity to support and according to Garner's theory to develop kinesthetic intelligence.

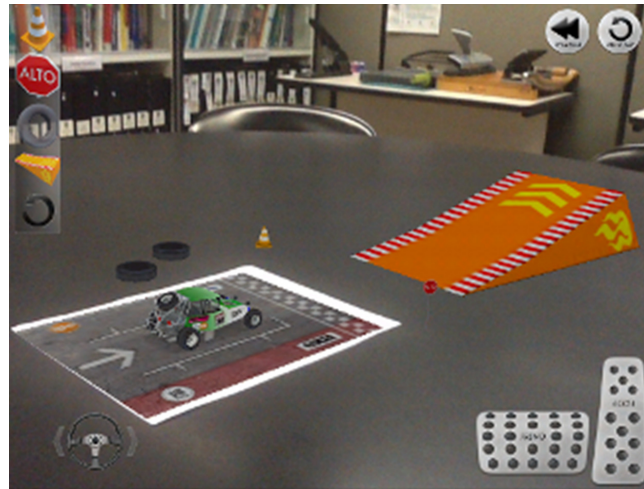


Fig. 4. Augmented Reality Game.



Fig. 5. Images of Adventurers Book.

Prizes like collecting items, and an extra mini-game make up for the extra motivation to learn. This will reward and acknowledge effort and will move learners forward, no matter where they stand. An original innovative gameplay becomes a big motivation for kids to continue searching and unlocking the full potential of the app, while feeding them with concepts to learn and addictively for repetition.

Based on these ideas, we created an augmented reality game, which overlays a remotely controlled virtual car to the mobile camera image on screen.

3. Conclusions

One of the main challenges was to identify the type of student prior knowledge to the use of tablets in the educational process.

The usability of the application was another project by itself. Consider many elements in the graphics and the use of the characteristics of the device increases the complexity of the application.

Being able to use two of Gardner's multiple intelligences in the instructional design of the questions and the correct way to ask the student always looking for us was very gratifying to see the result of learning and its application in the classroom.

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